



# Critical failure factors in information system projects

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## Abstract

The rate of information system project failure remains high in comparison with other high-tech projects. The objectives of this paper are firstly, to create a systemic framework that is broad enough to represent a wide range of possible factors that may impact systems performance; and secondly, to use the framework to delineate and assess the impact of different classes of influencing factors. The proposed framework is a triple-system(S) model comprising a set of three sub-systems of strategic project planning and delivery process, the organizational contexts and a formalized technology-enabled information system. A Singapore-based survey is conducted to determine which failure factors are perceived as the most influential based on the respondents' experience in a major 'failed' project. The triple-S framework then delineates these influencing factors for analysis, which in turn generates further insights and focuses. © 2002 Elsevier Science Ltd and IPMA. All rights reserved.

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## 1. Introduction

Computerized information systems (IS) are pervasive in all forms of business organizations. Recent studies show that many of these projects have 'failed', in the combination of budget and/or schedule overruns and/or for not meeting users' requirements. The well known and now widely quoted Chaos Report by Standish Group [1] declared that software projects are in chaos. Table 1 provides a summarized report card on project outcomes based on the Report.

Type 1 projects are those completed on time and within budget, with all required functions and features initially specified. The "challenged" projects, though completed and operational, suffered budget overruns and/or program slips, and offered fewer functions and features than originally specified. The "impaired" projects are those cancelled or abandoned at some point during the development cycle. It is anticipated that many of the IS projects would continue to be 'challenged' or 'impaired'. The truly 'successful' stories from the outset will be relative rare. The problem of systems impairment is more serious when projects are terminated or abandoned because of potential damages to organizations.

Unlike engineering projects, project impairment may not necessarily be due to technical faults. In information system development, an acquired or implemented system, even technically sound with specifications met, may still meet with resistance or rejection by the users or corporate management. The resulting under-utilization or abandonment of a system certainly represents a major failure. The issue of system acceptance may go beyond the usability and technical quality of the final product; extending to other more complex soft issues that are social and cultural in nature, including politics in information management.

It is important that the information technology community together with other stakeholders have a better understanding of the nature of software or information system projects and the special problems of the widespread systems failures. Checkland and Holwell [2] reckon that the study of information systems remains a crucial but confused field. Lyytinen and Hirschheim [3] suggested that the study of system failure still suffers from an inadequate conceptual clarity of the information system failure notions.

## 2. Definition and purpose of information systems

The term "information systems" has been defined to denote any of a wide combination of computer hardware, communication technology and software designed

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to handle information related to one or more business processes [4]. It serves to coordinate the work of many different organizational functions, from a back office administration support, to a company's strategic management tool. The payroll, sales orders, inventory control and personnel records systems are some examples of back office administration support systems. For industries such as banking, travel and insurance, IS are part of the operating core of the organization. Implementation of an information system involves the design, delivery and use of the software system in the organization.

The subject of IS studies is interdisciplinary, integrating technological disciplines with management and other disciplines such as psychology and sociology [5]. An information system is user-interfaced and designed to provide information and information processing capability to support the strategy, operations, management analysis, and decision-making functions in an organization. The system uses information technology (IT), manual procedures, models, and knowledge bases and databases. Applications may improve operational efficiency, improve and innovate functions, or restructure business processes. An information system stores, processes and delivers information relevant to an organization, in such a way that the information is useful to those who wish to use it, including managers, staff, customers, and suppliers. An information system may or may not involve the use of computer systems.

### 2.1. Basis for the existence of IS

Information has a meaning and use to a particular recipient in a particular context. It comes from selecting, summarizing, and presenting data in such a way that it is useful to the recipient [5]. Information is also defined as structured data that has a contextual meaning. It provides the user with the knowledge to make the necessary decisions. Information systems thus are supposed to inform people (who in the IT context, are called users or clients) and this is the primary objective of the existence for information systems [6]. From the systems thinking view, information systems exist to serve, help or support people taking action in the real world [7]. The "action" of the real world could mean anything from increasing the efficiency of the workforce to consolidating the resources under the power and control of one person. The objective of IS existence is sometimes mixed with politics which are hard to detect.

Table 1  
Project resolution by type

Project outcome	Resolution	%
Type 1	Successful	16.2%
Type 2	"Challenged"	52.7%
Type 3	"Impaired"	31.1%

## 3. Notions of IS failure

### 3.1. Systems failure notions

Lyytinen and Hirschheim [3] define four major notions or categories of IS failures as follows:

1. **Correspondence Failure:** When the systems design objectives are not met, the information system is considered a failure. It is generally believed that design goals and requirements can be specified clearly in advance, and that their achievements can be accurately measured. Performance measures mainly based on cost-benefit analysis are employed for managerial control over the systems implementation. Correspondence failure, goal-seeking in outlook, tends not to recognize that users may not necessarily accept systems that meet design objectives and specifications.
2. **Process Failure:** A process failure occurs when an IS cannot be developed within an allocated budget, and/or time schedule. There are two likely outcomes of process failure. Firstly, an outright failure occurs when no workable system can be produced. Secondly, a more common outcome is when an information system is developed with massive overspending in both cost and time, thus negating the global benefits of the system. This is a project level failure attributed to unsatisfactory project management performance.
3. **Interaction Failure:** The level of end-user usage of the information system is suggested as a surrogate in IS performance measurement. Some related measures of IS usage include user attitudes and user satisfaction, the amount of data transferred or the frequency of use. However, heavy usage does not necessarily mean high user satisfaction and improved task performance, and there is little empirical evidence supporting such a claim. Heavy systems usage might be a result of legal compulsion, persuasion, or that there are simply no other alternatives besides using the system.
4. **Expectation Failure:** The notion of expectation failure views IS failure as the inability of a system to meet its stakeholders' requirements, expectations, or values. Failure, therefore, does not only involve the system's inability to meet design (technical) specifications. Expectation failure is perceived as the difference between the actual and desired situation for the members of a particular stakeholder group. Unlike the other three notions, IS failure is considered holistically in this case, as the views of different stakeholders are taken into account.

### 3.2. The drivers of systems performance

The four drivers of system performance are context, content, process and outcome. They are the driving forces in initiating a strategic change intervention through system implementation. The purpose of an intervention is to specify and effect the content of change that delivers an outcome that satisfies a strategic intent. A successful intervention requires a process that appropriately integrates and reconciles the content and context in order to achieve the desired outcomes that fulfill the intent of the strategic initiative [8]. The four drivers can be coherently integrated and represented as a framework, as illustrated in Fig. 1, which is in line with Pettigrew's [9,10] framework for strategic change analysis.

## 4. Critical factors in IS failure

### 4.1. Critical failure factors

Flowers [4] defines an information system as a failure if any of these following situations occurs: (1) when the system as a whole does not operate as expected and its overall performance is sub-optimal; (2) if, on implementation, it does not perform as originally intended or if it is so user-hostile that it is rejected by users and under-utilized; (3) if, the cost of the development exceeds any benefits the system may bring throughout its useful life; or (4) due to problems with the complexity of the system, or the management of the project, the information system development is abandoned before it is completed.

Flowers used large systems failure cases to illustrate the performance of software system projects as a function of

managing a range of critical failure factors (CFFs) as in: organizational, financial, technical, human, and political factors, and the interaction among these factors. The failure factors can be broadly grouped in the organizational and managerial contexts and the actual conduct of an IS development project. Possible failure factors in the organizational and managerial contexts include hostile company culture, improper reporting structure, political pressures, vested interests, influences, and inappropriate level of management commitment. Key influencing factors in the conduct of project itself include pre-occupation with technology in project planning, technology focus over human relations, complexity under-estimated, poor stakeholder management, poor consultation, design by committee, technical fix for a management problem, poor competence of project management and project team, and poor selection decisions.

### 4.2. Termination failure

Sauer [11] proposes that systems should be considered as a failure only if there is a development or operation termination. Based on this criterion, the failure model takes the natural systems approach, which explains systems behaviour in terms of the goal of survival. This approach describes the achievement of survival through acting on the environment so as to obtain necessary resources (funding) that in turn support the system's continued operations. A system is not considered a failure as long as it survives and continues to attract support in resources. The concept first considers information system as a product of a coalition of stakeholders, which includes project organization, which assumes the major part of developing, operating, and maintaining the information systems in question. With support and commitment from the supporters or promoters, the project organization is able to carry out its work, ideally with a view to serve the interest of the supporters. This creates a "triangle of dependences" as illustrated in Fig. 2. Failure occurs when the level of dissatisfaction with a system rises to the extent when there is no longer enough support to sustain it.

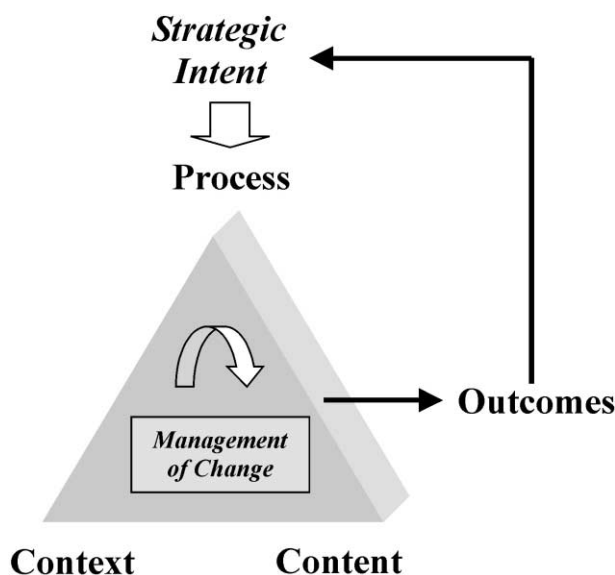


Fig. 1. Framework of drivers of change.

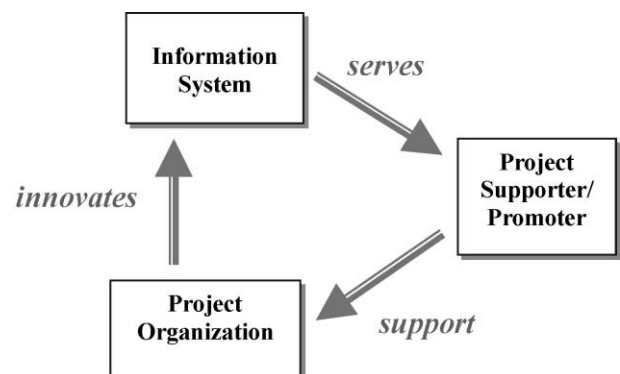


Fig. 2. Triangle of dependences.

Information system failure is indicated by the cessation of all the work related to the system. Termination failure thus refers to a total abandonment of the project.

### 5. In search of an integrative framework

To deal with the highly complex field of IS study in general and systems failures in particular, a soft systemic approach is proposed in search of an integrative and generic framework for analysis. The systemic approach simultaneously deals with the logical and cultural/social aspects of systems development and use. The POM (Processes for Organizational Meanings) model developed by Checkland and Holwell [2] provides an important conceptual reference model to make sense of the studies. The POM model can be represented in three interacting parts of the main “discourse” processes (Part 1) linking and reconciling the “organization” context (Part 2) with the organized “information system” (Part 3) with embedded information technology and business process contents.

Briefly, the POM model represents a social process in the provision of information system that supports people in organization to take purposeful action in the ful-

fillment of organizational goals. The use of information system can be thought about as entailing a pair of constituent systems:

1. a system which is “served”, denoted as S1, the primary system, in this paper, and
2. A system that does the “serving”, denoted as S2, which is supporting.

The serving system which is the formalized information system, contains the processing of selected data and information relevant to people operating in the organization. The twin systems are linked and entailed in the concept of a purposeful “information system,” which is more than a computer-based number crunching system.

This paper proposes and gives emphasis to an explicitly expressed third system, the strategic project planning and delivery process system, denoted as Sp, and as illustrated in Fig. 3. Sp is enabled by a deliberate project organization that operates in the organizational context of S1 with the objective to deliver a successful S2.

The strategic project planning and delivery (Sp) system assumes the role and responsibility in overseeing the whole process of making preparation for, planning, coordinating and control of the entire strategic formulation, and the associated social and technical

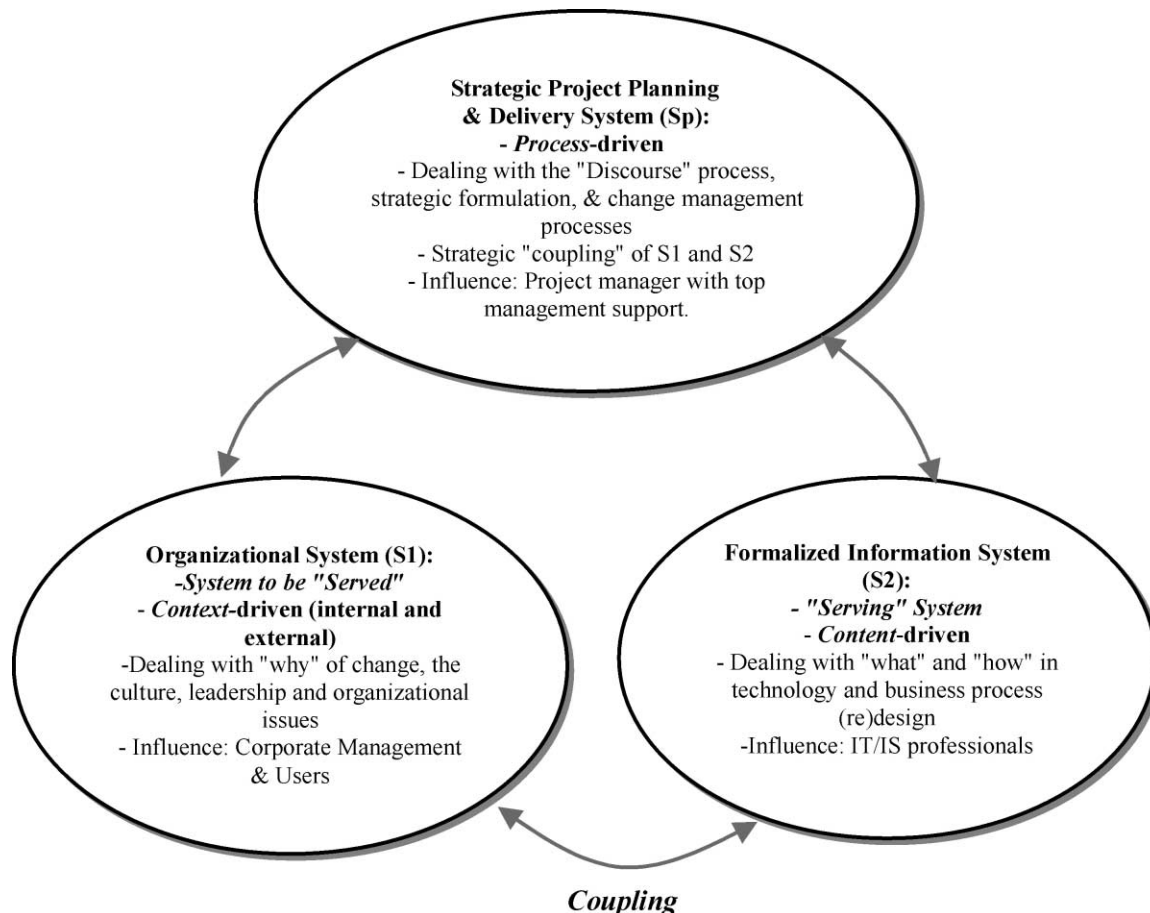


Fig. 3. The triple-S framework for IS planning.

processes in information systems development and implementation. The process begins from the initiation of the discourse to the design and acquisition of the formalized information system that supports the organizational members in their accomplishment of tasks.

Fig. 3 illustrates the proposed “triple-S” framework. The generic framework is suited for the strategic planning and change management of IS implementation. The Sp system in the triple-S framework includes and goes beyond the traditional project management role and responsibility with pre-occupation with the “how” and “what”. The traditional pre-occupation is mainly concerned with technical and business/work process design contents, which characterize the S2 system. The project management must now also be involved in creating the big picture and in thinking about strategic formulation, in making a business case and managing the resulting change processes.

The change processes focus on the thorough process analysis involving the discourses in search of meaning, purposes, accommodation and intents. The IS project manager when dealing with the Sp system, is likely to use the soft systemic approach to deal with the many ill-structured and messy problems to be encountered in the system development process. The discourse processes can be highly political in nature. The traditional project management largely based on “hard” systems engineering approach will be found to be inadequate and incapable of coping with many of the ill defined ‘soft’ problem situations. The Sp system, which is under the influence of information system project managers, with the support and commitment of top management, must

ensure the proper coupling of the content-driven “serving” system and the context-driven “served” system in the change processes.

## 6. Delineating failure factors

### 6.1. Spheres and issues of influence

The identification and delineation of information system failure factors can be a highly complex task. The integrative triple-S framework is used as a basis to group and analyze a multitude of possible factors that may cause an information system to fail. The triple-S framework can be perceived as three *spheres of influence* (SOI) over project outcomes. The three SOI are further operationalised into 10 main issues of influence (IOI), as shown in the Table 2. These issues are in turn defined by a list of failure factors filtered out from an in-depth literature review on information system and system failure studies.

### 6.2. Failure factors analysis

Failure factors analysis is based on 92 usable returns from a Singapore-based questionnaire survey conducted in November 2000. The respondents’ responses were based on their experience on one IS project which had been challenged or impaired. The following present a partial result on the key influencing factors, which may have contributed to the project failures. These factors can be evaluated under 10 different issues of influence

Table 2  
Defining ‘Issues of influence’ under the three ‘Spheres of influence’

Sp Process driven issues	S1 Context driven issues	S2 Content driven issues
<i>Related to</i> (1) Business planning (2) Project planning (3) Project management and control	<i>Related to</i> (4) Corporate culture (5) Corporate management (6) Users (7) Politics	<i>Related to</i> (8) Information technology (9) Business process and system design (10) IT/IS professional and knowledge sources

Table 3  
Top 5 failure factors under Sp, S1 and S2

Rank	Sp Process driven issues	S1 Context driven issues	S2 Content driven issues
1	Underestimate of timeline	Lack user involvement and inputs from the onset	Consultant/vendor underestimated the project scope and complexity
2	Weak definitions of requirements and scope	Top down management style	Incomplete specifications when project started
3	Inadequate project risk analysis	Poor internal communication	Inappropriate choice of software
4	Incorrect assumptions regarding risk analysis	Absence of an influential champion and change agent	Changes in design specifications late the project
5	Ambiguous business needs and unclear vision	Reactive and not pro-active in dealing with problems	Involve high degree of customisation in application

Table 4  
Relative ranking of the Issues of Influence

Rank	Issues	Symbol	Mean
1	Project planning	PP	2.85
2	Corporate culture	CC	2.77
3	Project management and control	PMC	2.74
4	Business process and system design	BPSD	2.65
5	IT/IS professionals	IT/ISP	2.64
6	Information technology	IT	2.59
7	Users	U	2.58
8	Corporate management	CM	2.53
9	Politics	P	2.50
10	Business planning	BP	2.50

(IOI) and the three dominant spheres of influence (SOI) as defined in the triple-S framework. The statistical analysis takes into consideration extreme and diverse views of the respondents (rating 1 through 5) and the mean score is used as indicative of the relative importance of the factors.

About half of the first one-third of the failure factors listed belong to the Sp sphere influence, highlighting a significant proportion of problems information system projects faced are related to project planning issues. Table 3 lists the top five factors categorized under Sp, S1 and S2 sphere of influence respectively.

Table 4 presents the relative mean scores under the 10 different issues of influence (IOI). Project Planning (PP), Project Management and Control (PMC) and Corporate Culture (CC) have higher scores, which are indicative of their relative significance.

## 7. Conclusions

The IT/IS industry and community continue to be plagued with extensive problems of systems failure. The field of IT/IS project management remains in “chaos”. The gap between theory and practice in IS studies, particular failure studies, remains. The study presented in this paper is another attempt trying to make sense of the somewhat ‘confused’ field of IS studies in general and IS project management in particular. The emphasis is on

adopting a systemic approach in IS project planning and delivery process. The tentative outcome of this study is the proposal of a triple-system(S) framework built on the basis of soft systemic thinking. There is a high degree of congruence and consistency among the previous IS studies and the soft systemic thinking. The idea of coupling the systems “serving” and “served” in a master–servant relationship is a very useful and worthy one and should be considered indepth. The paper highlights the importance of the third system, Sp, as an explicitly expressed process- and outcome-driven entity that ensures the integration and coupling of the served and serving systems.

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